Dental microwear features as an indicator for plant food in Early Hominids: A Preliminary Study of Enamel. 1986.

P.-F. Puech, F. Cianfarani, H. Albertini.**Human Evolution 1 (6): 507-515.** **Extract:**

Studies of dental microwear have shown qualitative and quantitative differences related with specific diets of mammals. Here we report a classification of the features of microwear and the results of a comparative study of the characteristics of wear produced by plant food. Species which are mainly folivorous or herbivorous show common features useful for **providing information about the diet of early hominids at Garusi and Laetoli (Tanzania), Hadar (Ethiopia) and Olduvai (Tanzania).**

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Observations do not deal with the precise position of wear patterns on the surface of teeth and thus it can not be done functional interpretations of the microwear features. The results concern similar wear features in different species and in different positions of the dental occlusal surfaces. The term furrows is applied to structures differing from striations in regularity, size and spacing. They may represent the alternating rod and interred substance of enamel, which tends to be oriented perpendicular to the buccal surface. The furrows may also represent the alternating arrangements of enamel rods. The characteristics of furrows are probably derived from a multiplicity of factors operating during the complex movements involved during the mastication of plant tissue (Rensberger, 1978).

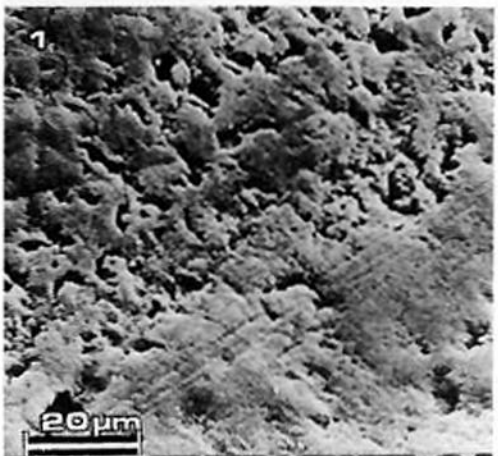

Figure 1 - Smooth human enamel with fissures and deepened rod ends; direct observation with SEM (A. Thylstrup courtesey).

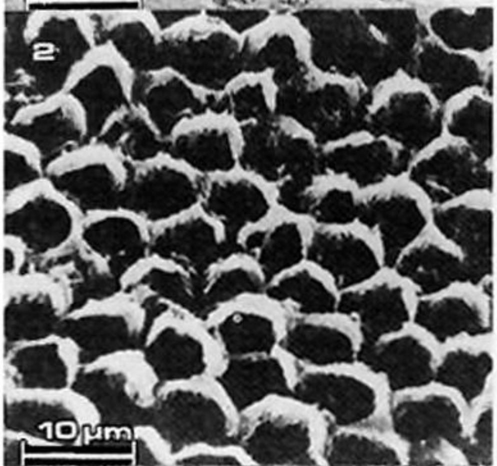

Figure 2 - One stage duplicated surface of human enamel after acid etching. The interrod ridges are forming oriented lines.

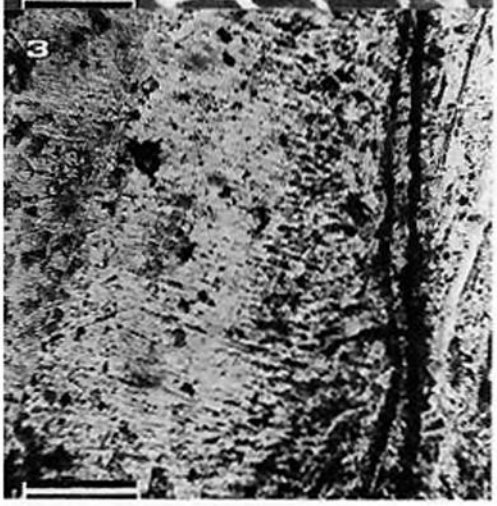

Figure 3 - The special enamel microwear observed on the incisors of *Homo habilis* (O.H. 16) at Olduvai has the pattern described in next figure for ancient Egyptian: polish is dominant but furrows occurs on the labial incisal surface. Scale bar, 140 µm.

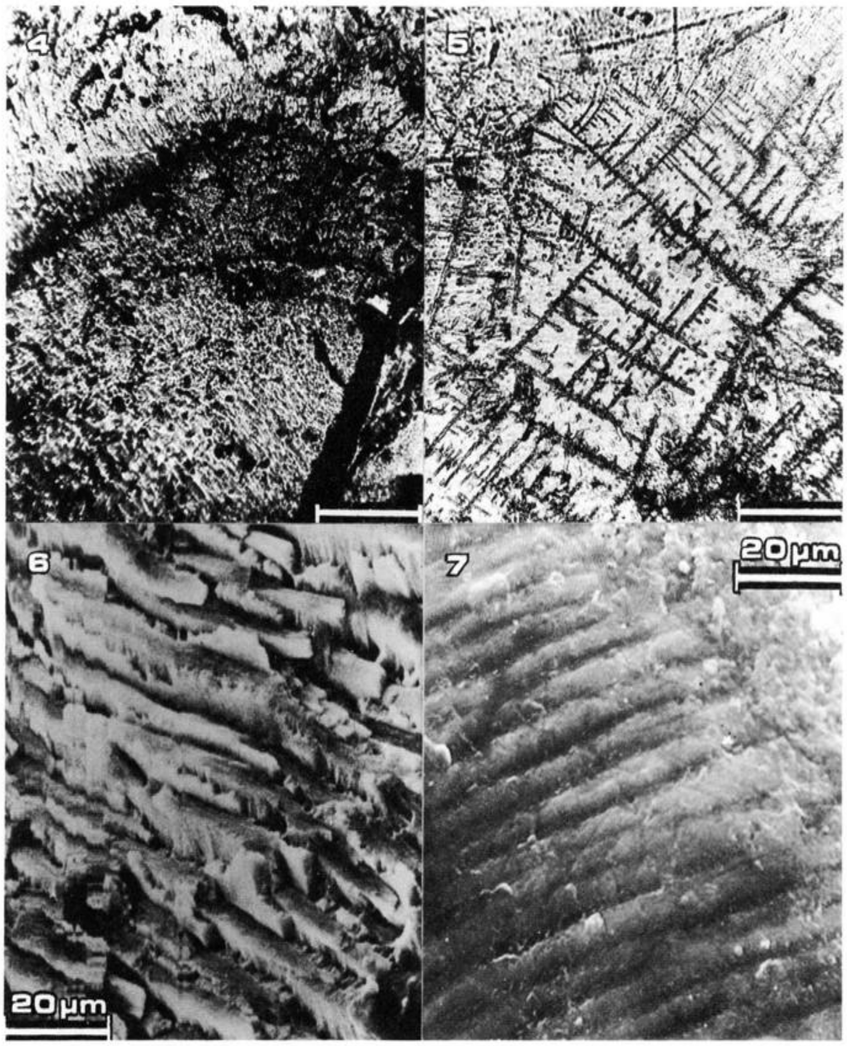

Figure 4 - Enamel in ancient Egyptian dentitions have a blunt surface with furrows. Scale bar, 140 µm.
Figure 5 - In early *Australopithecus* (A.L. 145.35) small pores are joining in some places to form grooves on enamel. Scale bar, 140 µm.
Figure 6 - Fractured enamel of sheep shows the alternative direction of the enamel rods.
Figure 7 - Rounded occlusal enamel surface of sheep teeth and furrows with the same spacing as observed in Figure 6.

A better understanding of furrow formation can be gained by the study of the following Figures 6 and 7. They represent scanning views of sheep's enamel at approximately the same magnification. Figure 6 shows a section of fractured enamel and it reveals the regularity of the alternating orientation of the enamel rods. The rods in a given direction have the same spacing as can be observed in the furrows of the occlusal surface shown in Figure 7.

The highly abrasive vegetable foods are, in the presented cases, leaves and grasses but we must distinguish the abrasives present into constituents and contaminants. The source, nature and effect of contaminants are variable

contaminants are variable. Dust is picked up by air currents and rain. Natural soils contain abrasive materials in amounts varying from 90% down to 20% by weight and the major abrasive is silica. The grainsize of 80% (by weight) of storm dust varies between 0.2-2 µm (DUCE *et al.*, 1980). Windblown particles vary in size but infrequently exceed 200 µm, and dirt adhering to plant roots may exceed 200 µm (PUECH *et al.*, 1980). Amorphous silica found in the cells of certain plants varies in dimension between 5-100 µm. The larger phytoliths consist of long prisms which fracture when subjected to very small pressures. Phytoliths produce very fine striations and have a reinforced polishing action because they are embedded in cellular tissue and only a small part of the silica is available to act on the

In the gorilla, the fine demarcation between the furrows may break down, thus producing new large grooves, very similar to crenulations, which are considered to be intermediate features (Figure 8). The differences observed between the furrows, of sheep and gorilla, provide evidence relating to the enamel prism arrangement. The furrows in sheep molar teeth can only be produced by the process of mastication of *graminae*. These plants contain a siliceous skeleton of opal phytoliths. Grasses (*graminae*) contain phytoliths, and Walker et al. (1978) accept the fact that amorphous silica is responsible for the high density parallel scratches varying in size from 0.2 to 1µm. Figure 7 does not show evidence for scratches. Thus the amorphous silica has acted, as it can be seen at low magnification, as a polishing agent producing furrows.

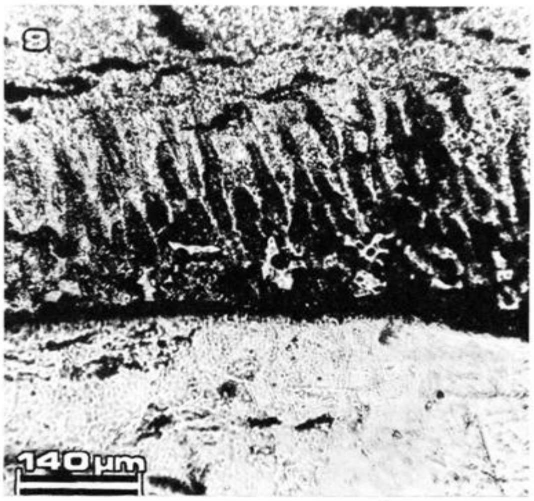

Figure 8 - Incisor gorilla enamel: fine demarcation between the furrows may break down thus producing new large grooves running from the enamel-dentine junction, the grooves are almost regularly spaced.

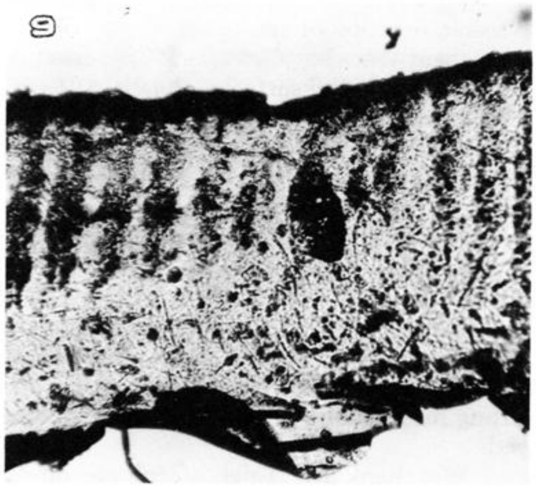

Figure 9 - The disto-occlusal surface of upper right canine in early *Australopithecus* A.L. 200 from Hadar with crenulations due to Hunter-Schreger bands of enamel. Spaced at about 0.2 mm; similar appearence is observed in front and cheek teeth, at various degrees, of early *Australopithecus* from Laetoli, Garusi and Hadar.

masticating surface of the tooth. Sheep that feed primarily on grasses in spring show the fabric-like grooves sometime observed in the highly folivorous gorilla.

Different enamel structures, differences in hardness, abrasion resistance, occlusal pressures and food choice are reflected by different features of wear such as furrows and crenulations. Crenulations occur on worn surfaces of enamel with ridges spaced almost regularly at about O.2 mm. These crenulations have been detected on cheek tooth facets of herbivores where food abrasion is dominant (Rensberger & Von Koenigswald, 1980), as well as on hominids on front and cheek teeth (Puech, 1980).

The ridges are caused by the differential resistance to abrasion of the alternating sets of prisms described as Hunter-Schreger bands (H-S-B). The ridges occur when the H-S-B are oriented normal to the worn surface and this may serve as a resistance to enamel wear where there is a concentration of masticatory forces. Rensberger & Von Koenigswald (1980) suggested that the ridges might serve for «holding vegetation between the teeth and thus increasing tension on the fibers as it is cut». The fact is that the H-S-B take the